California Bridges and Structures Strategic Direction

2014





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This California Bridges and Structures Strategic Direction (hereafter referred to as "Strategic Direction") is the result of many hours of hard work that began with the Caltrans Division of Engineering Services (DES) Structure Policy Board (SPB) in 2011. The SPB assembled a diverse Task Force comprised of Caltrans managers who met for one year in multiple three-day brainstorming workshops to create the Strategic Direction. This document was vetted through the federal, state, and local transportation communities; all comments received to date have been addressed.

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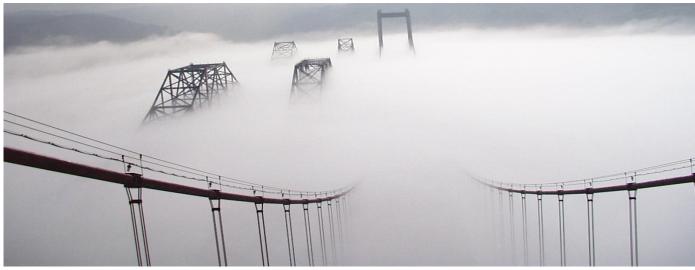
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Carquinez Bridge, Hwy 80, Solano County, Caltrans



Bixby Creek Bridge, Hwy 1, Monterey County, Caltrans

EXECUTIVE SUMMARY

The public deserves bridges and structures that are safe, sustainable, cost effective, well-built, and maintained in compliance with all applicable regulations. The California Bridges and Structures Strategic Direction (Strategic Direction) is a roadmap for the integrated management of ALL bridges and structures located on public roads in California. Through an integrated management approach, Caltrans and transportation partners can more effectively address California's bridge and structure needs to best serve the traveling public.

The great State of California is faced with a number of challenges that influence our ability to effectively manage the complex bridge and structure infrastructure. Major challenges include:

- AGING INFRASTRUCTURE
- POPULATION GROWTH
- MULTIPLE STAKEHOLDERS
- CHANGING TRANSPORTATION NEEDS
- INADEQUATE FUNDING
- COMPETING INTERESTS
- ENVIRONMENTAL CONSTRAINTS
- LEGISLATIVE MANDATES
- SUCCESSION PLANNING



Bridgeport Bridge, Nevada County, Caltrans

In light of these challenges, it is in California's best interest that all stakeholders involved in the management of bridges and structures collaborate to meet shared goals. This Strategic Direction is a collaborative effort to manage these assets independent of ownership or funding sources. The Strategic Direction identifies 12 objectives and 24 strategies that maximize innovation, sustainability, integrated planning, design, construction, and maintenance of bridges and structures.

Regardless of the method of procurement or implementing agency, through integrated leadership, the Strategic Direction will maximize asset performance and minimize total lifecycle costs.

Finally, the Strategic Direction will utilize performance-based metrics to gauge the effectiveness of the outcomes.

BACKGROUND



San Francisco-Oakland Bay Bridge East Spans, Hwy 80, Caltrans

California's highway system and complex bridge infrastructure are the lifeline of the California economy. The general public, businesses, and travelers from around the world utilize this vital asset to go about their daily lives and carry out their business. Caltrans and local agencies manage more than 26,000 bridges on California's roads and highways. This infrastructure is a legacy system largely built by Caltrans during the 1950s, '60s and '70s utilizing a design-bid-build model. The model worked well as the State systematically created one of the most advanced transportation systems in the world during a period of tremendous economic expansion.

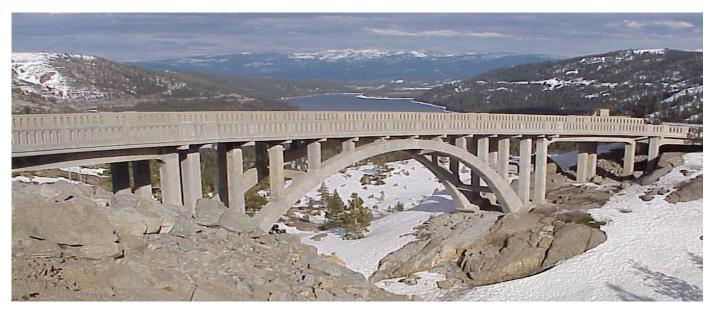
The world and environment that we live and work in has changed. We are now in an era that prioritizes environmental sustainability, quality of life, and preserving the highway system that was largely created decades ago. Many new players have entered the arenas of bridge and transportation structure design, construction, and management. In addition, projects are now delivered through several delivery methods (design-bid-build, design-build, private-public-partnerships, construction manager, general contractor, etc.) and paid for by numerous funding sources. The uniformity and quality afforded by a single provider (procurement, delivery, application of legal mandates and guidance) through the legacy system has changed. While this change is not necessarily a bad thing, it does introduce the risk of inconsistent safety, performance, quality and durability, as well as other potential impacts to the public.

There is a need for uniform direction to better manage bridge and structure assets to reflect the current environment we live in. Decisions regarding the design, construction, and maintenance strategies of bridges and structures need to be made in an

integrated manner that considers the entire lifecycle of the assets and does not adversely affect the quality or safety of ALL bridges and structures located on public roads in California, regardless of who does the work.

Bridge and structure owners – whether they are state or local agencies – are responsible for the design, construction, and maintenance of California's bridges and structures. They need uniform direction and guidance to ensure that decisions are made in an integrated and consistent manner. If decisions are not integrated and consistent, the consequences of error can be significant. Increased lifecycle costs of these assets – including project support, initial capital costs, and long-term maintenance – may result, which will ultimately adversely impact the traveling public.

Nationally, the Federal Highway Administration (FHWA) and the transportation community have recognized a shift in focus away from building new transportation systems to preserving and improving existing systems, as evidenced in recent legislation such as Moving Ahead for Progress in the 21st Century (MAP-21). Similarly, California is shifting its focus toward asset preservation, sustainability and management.



U.S. Route 40, Rainbow Bridge, Placer County, Caltrans

REGULATIONS

This Strategic Direction is a guiding document intended to comply with all corresponding federal, state and local laws, regulations, and governing codes for the National Highway System (NHS), State Highway System (SHS), non-NHS, non-SHS, and local streets and roads. Major governing codes and regulations include:

- U.S. Code of Federal Regulations¹
- California Streets and Highways Code²
- Various Caltrans Deputy Directives^{3,4}

Sources:

- 1. U.S. Code of Federal Regulations Title 23 Highways, Part 625 Design Standards for Highways
- 2. California Streets and Highways Code Sections 137 and 141
- 3. Caltrans Deputy Directive 23 R1: Roles and Responsibilities for Development of Projects on the State Highway System
- 4. Caltrans Deputy Directive 44: Federal-Aid and State Funded Highway Local Assistance



Pitkins Curve Bridge and Rockshed, Hwy 1, Monterey County, Caltrans

THE STRATEGIC DIRECTION

The Strategic Direction is a roadmap for delivering and managing ALL public bridges and structures in California to ensure that they are safe, durable, and cost effective through integrated leadership, independent of ownership or financial funding. Objectives and strategies were written to ensure that bridges and structures delivered by the aforementioned various delivery methods are consistent in all aspects and seamless in performance and value to the traveling public. The intent is not to solve all the challenges of managing bridges and structures in the 21st Century, but rather to deliberately and transparently establish a clear direction that the numerous partners in the transportation community can embrace and follow.

This roadmap clarifies what is important and integrates decision making to ensure greater consistency. When bridge managers are considering a decision, they need to weigh the impacts to the Strategic Direction objectives. Ultimately, if a decision adversely affects one of the objectives, it is probably not the best choice, and the associated risks need to be carefully considered. The Strategic Direction is a litmus test, and should be used for that purpose.

DELIBERATELY AND TRANSPARENTLY ESTABLISH A CLEAR DIRECTION THAT THE NUMEROUS PARTNERS IN THE TRANSPORTATION COMMUNITY CAN EMBRACE AND FOLLOW.



Retaining Wall, Caltrans

EXPECTED OUTCOMES

The following results are intended to be delivered by this Strategic Direction approach:

- ✓ Integrated planning, design, construction, and maintenance decision-making regardless of the method of procurement or implementing agency
- ✓ Sustainable bridges and structures
- ✓ Consistent and appropriate quality and management of risk
- ✓ Reduced project delivery costs and delays
- ✓ Maximized asset performance and minimized total lifecycle costs
- ✓ Improved tools and training
- ✓ Effective use of emerging technologies (i.e. research, new materials, etc.)

The Strategic Direction focuses on long-term, cost-effective and sustainable strategies that address:

- ✓ Structure Design (loadings, geotechnical, seismic, hydraulic, and preservation)
- ✓ Structure Construction (specifications and contract administration)
- ✓ Asset Management (inspection and maintenance programming priorities)
- ✓ Resources and Tools (standards and guidance, staff skills, and software)
- ✓ Innovation (research, new materials and structural systems, technologies, and construction methods)
- ✓ Quality and Risk Management (including lessons learned)

The Strategic Direction will utilize performance-based metrics to gauge the effectiveness of the outcomes. Existing performance metrics will be used where applicable and new ones will be developed as required.





Devil's Slide Tunnel, State Route 1, San Mateo County, Caltrans

OBJECTIVES AND STRATEGIES

The Strategic Direction identifies **12 objectives and 24 strategies** that maximize innovation, sustainability, integrated planning, design, construction, and maintenance of bridges and structures (hereafter referred to as "structures") in California. California will improve mobility by investing in its structures in a manner that will:

1. Minimize accidents

Work zone accidents and vehicle crashes must be minimized in order to provide a safer transportation system. Structures must be delivered and maintained in a way that ensures public safety and reduces worker and motorist exposure to injuries and fatalities.

Strategy:

1.1. Communicate safety performance standards for design features and construction procedures that reduce the potential for accidents to minimize worker and motorist risk.

2. Minimize traffic delays

Traffic delays must be minimized in order to maximize system performance. The delivery of structures must aim to minimize delays to the traveling public and movement of goods during normal operations as well as during construction and maintenance activities.

Strategy:

2.1. Factor in user delay costs when planning and designing structures, and promote accelerated delivery of structures to reduce traffic delays where appropriate.



5/14 Interchange in LA County, Caltrans

3. Ensure reliability and structural integrity

Reliability and structural integrity are paramount in order to ensure safe operations. Structures shall be constructed and maintained in a way that ensures safety, functionality, and durability while optimizing service life.

Strategies:

- 3.1. Optimize the design service life of structures by developing performance-based design and construction criteria for factors such as anticipated service life, post-earthquake serviceability, and structure component replacement/rehabilitation.
- 3.2. Improve the management of ancillary structures (e.g., retaining walls, sign structures, sound walls, etc.) by developing a statewide inventory, structural sufficiency ratings, and an archive for as-built drawings.
- 3.3. Develop mechanisms to promote preservation by configuring funding to promote the maintenance of structure assets.

4. Optimize flexibility in meeting future intermodal transportation needs

Structures must be adaptable to future transportation needs to ensure that public funds are wisely invested. The planning and design of structures must consider attributes that provide for flexibility to address changing needs.

Strategy:

4.1. Improve structure adaptability for future needs. Anticipate transportation demands (e.g., new technologies, utilities, maintenance technology, etc.).

5. Meet established standards and policies consistent with laws, regulations, codes and agreements.

It is imperative to develop and adhere to standards and policies for structures that follow current laws, regulations, and codes to ensure the integrity of the transportation system and promote public trust.

Strategy:

5.1. Improve the process for reviewing contract documents and communicate them in a timely and clear manner to all stakeholders.

6. Assure quality

The consequences of poor quality are of great concern due to the critical nature and significant cost of structures. Therefore, it is important to establish and enforce quality management standards to protect the public's investment in structures.

Strategy:

6.1. Improve, standardize, and align quality management practices for all stakeholders and ensure consistent application of quality standards.

7. Ensure open communication between all stakeholders

The delivery and management of structures involves many different entities. In order to ensure that these assets are delivered and managed effectively, continuous communication among these entities is vital.

Strategy:

7.1. Continue to foster communications between key stakeholders through forums and other formal channels to communicate structure-related topics and by engaging the industry in standards development.



Tower Bridge, Sacramento, Caltrans

8. Balance performance, lifecycle cost, time, delivery, and risk to optimize total value

The delivery and management of structures should maximize the public's return on investment. Therefore, decisions must be framed to promote the best value over the life of the asset while integrating risk-based thinking into decision-making.

Strategies:

- 8.1. Optimize capital, operating, and maintenance costs by establishing lifecycle cost analysis procedures and developing a more flexible, range-based estimating system for structures.
- 8.2. Implement an enterprise risk management program specific to structures.
- 8.3. Improve the decision-making process and tools to help identify "best value" outcomes for structures (e.g. structure-type decisions and delivery method selection).
- 8.4. Review and evaluate project delivery processes in order to streamline or eliminate inefficiencies.
- 8.5. Fully consider all available delivery methods; formalize and promote new approaches.
- 8.6. Advocate for funding to support advanced planning activities where they have the greatest impact to influence decision-making (e.g., provide funding for the performance of critical analysis at the planning phase).

9. Preserve the environment and minimize impacts

Structures often play a significant role in either positively or negatively impacting the environment. Therefore, structures should be delivered and managed in a manner that minimizes impacts and preserves natural and cultural resources.

Strategy:

9.1. Develop and share sustainable environmental mitigation strategies related to structures between stakeholders, and ensure that environmental provisions are fully understood prior to project approval.



Culvert Invert Repair, Caltrans

10. Ensure transparency and accountability

Demonstrate prudent management of public funds by maintaining transparency and accountability in decisions and data related to structure assets.

Strategies:

- 10.1. Develop standardized structure maintenance agreements that define responsibility for maintaining special design features.
- 10.2. Enhance the accessible records retention system for the management of all structure assets.
- 10.3. Publish a biennial report that provides an accurate portrayal of bridge and structure conditions, expenditures, and needs in California and highlights potential risks (i.e., threats and opportunities).

11. Cultivate knowledge and experience

The public's expectation is that experienced and knowledgeable experts are responsible for delivering and managing structures. To support this, a culture of continuous improvement that fosters the sharing and retention of knowledge and experience is essential.

Strategies:

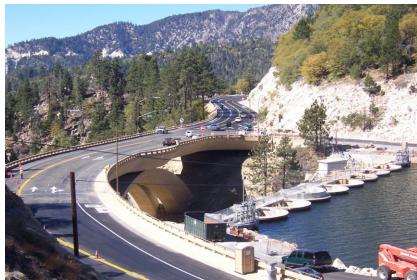
- 11.1. Establish a student internship program to attract interest in transportation-related careers.
- 11.2. Develop and implement joint training programs for stakeholders.
- 11.3. Develop stakeholder forums to enhance knowledge, share experiences, and advocate for transportation structures in California.

12. Encourage innovative solutions

Innovation is the catalyst for developing better transportation solutions. Emphasis should be placed on supporting an environment that encourages creative problem solving and intelligent risk taking.

Strategies:

- Identify specific statewide priorities for areas where innovation is most needed.
- 12.2. Promote innovation by proactively managing the incorporation of new technology, methods, and materials for structures.



Big Bear Bridge, Hwy 18, Caltrans

IMPLEMENTATION

It is the intent of Caltrans to implement many of the strategies and objectives identified in this document. It is anticipated that other entities will collaborate with Caltrans in this effort. This document will be updated biennially by Caltrans' Structure Policy Board.

The Implementation Plan will include these strategies:

- ✓ Develop Work Plans and Schedules for the 12 Objectives
- ✓ Develop Communication Plan
- ✓ Develop Webpage



Antlers Bridge, Hwy 5, Shasta County, Caltrans

APPENDIX: OBJECTIVES AND PERFORMANCE MEASURES

An initial effort was made to identify potential performance measures for the various objectives stated in the Strategic Direction. It is recognized that one of the biggest challenges is that while some measures may exist for certain entities already, they are likely absent for others. Therefore, there will be some initial challenges in identifying, collecting and analyzing performance data from all entities so that meaningful measurements can be made.

		PERFORMANCE MEASURES				
OBJECTIVES		SUCCESS MEASUREMENT?	MEASUREMENT TOOL (METRIC)	5-YEAR OR LESS TARGET	10-YEAR OR LESS TARGET	
1.	Minimize accidents	Reduce number of accidents within structure zone of influence Reduce worker accidents and motorist crashes in structure work zones	Structure Related Accidents (Property, Injury, Fatality)	Develop a global measurement tool	Make use of data to improve structure safety	
2.	Minimize traffic delays	Reduce traffic delays precipitated by structures Reduce traffic delays in structure work zones	Annual "Pinch Point" Report Avg. speed change from normal flow	Develop a global measurement tool	Make use of data to reduce traffic delays	
3.	Ensure reliability and structural integrity	Elimination of unplanned closures Bridge Health Indices meet established levels Avoid performance restrictions (e.g., load limits, etc.)	Closure count and related impacts Bridge Health Index Avg. improves	Develop metric Develop reporting program	Make use of data Integrate data into design and planning process	
4.	Optimize flexibility in meeting future intermodal transportation needs	 Build structures that anticipate future conditions and demands and do not require modification Increase number of bridges that are "adaptable" 	Structure Unit Cost for widening Develop adaptability rating score	Reduction over time Increase over time	Reduction over time Increase over time	
5.	Meet established standards and policies that are consistent with laws, regulations, codes, and agreements	Audit compliance with standards, codes, etc. Ensure that standards are kept current and maintained	Independent Audit Compliance with review cycles	Improve over time Meet review cycle	Improve over time Meet review cycle	

		PERFORMANCE MEASURES			
OBJECTIVES		SUCCESS MEASUREMENT?	MEASUREMENT TOOL (METRIC)	5-YEAR OR LESS TARGET	10-YEAR OR LESS TARGET
6.	Assure quality	Establish criteria for all structure quality Establish qualifications for critical staff functions	Quality Management Plan (QMP) compliance Staff qualification compliance	Deploy statewide quality standards Deploy statewide QMP	• 100%
7.	Ensure open communication between all stakeholders	Improve customer satisfaction levels between stakeholders (360° review) Positive feedback and attendance of forums	Customer Satisfaction Surveys	Improve over time	Improve over time
8.	Balance performance, lifecycle cost, time, delivery and risk to optimize total value	 Ensure that lifecycle cost analyses are performed at key decision milestones Formally consider risk in project selection and development Consider highway user delay in project selection and development Establish a "balanced scorecard" to assess value Projects delivered on-time Time savings from accelerated delivery 	Evidence that decisions are using lifecycle cost data Evidence that risk management is being applied Evidence that highway user delay analysis is being applied Projects that meet schedule Schedule savings Balanced scorecard or "Best Value" metric	Get techniques in place	Use data for process improvement



Eel River Bridge, Hwy 101, Mendocino County, Caltrans

		PERFORMANCE MEASURES			
OBJECTIVES		SUCCESS MEASUREMENT?	MEASUREMENT TOOL (METRIC)	5-YEAR OR LESS TARGET	10-YEAR OR LESS TARGET
9.	Preserve the environment and minimize impacts	Reduction in Notice of Violations (NOV) from resource agencies Meet Project Approval and Environmental Document Milestones on time (indicates good compliance) Reduction in permits required Customer satisfaction survey from resource agencies	NOVs Milestones met Environmental permit counts Customer satisfaction surveys	Reduction over time	Reduction over time
10.	Ensure transparency and accountability	Publish annual report on progress of strategic goals Increase public information availability and awareness Publish statewide funding accountability report Share lessons learned from annual project delivery	Annual Reports	Deploy first statewide report	Follow up with annual publications
11.	Cultivate knowledge and experience	Measure knowledge transfer through forum/symposium attendance Increase mentoring rates Increase training budget rates Establish statewide certifications for different areas of expertise	Training statistics Certification statistics Staff retention	Launch statewide program	Increase over time
12.	Encourage innovative solutions	Increase pilot program counts Increase use of alternative designs Increase state participation in national/international research and/or committees Increase rate of new product approvals	Number of innovations put into practice Pilot programs Participation rates	Get programs in place	Increase over time



Isleton Bridge on SR 160, Sacramento, Caltrans